

Patent No. 6,839,605  
Request for Cert. of Correction dated June 20, 2005  
Attorney Docket No. 2316-032210



10/718489 Cge

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No. : 6,839,605 Confirmation No. 8439  
Inventor : Park et al.  
Issued : January 4, 2005  
Title : Apparatus and Method for Diagnosing  
Faults In Hot Strip Finishing Rolling  
Examiner : Maria N. Von Buhr  
Customer No. : 28289

Certificate  
JUN 30 2005  
of Correction

REQUEST FOR CERTIFICATE OF CORRECTION OF PATENT  
FOR PTO MISTAKE (37 C.F.R. 1.322(a))

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

ATTENTION: Decision and Certificate of Correction Branch  
Patent Issue Division

Sir:

In accordance with 35 U.S.C. §254, we attach hereto Form PTO/SB/44 and a copy of proof of PTO errors and request that a Certificate of Correction be issued in the above-identified patent. The following errors appear in the patent as printed:

Column 33, line 64, Claim 18, "have a sane polarity" should read  
-- have a same polarity --  
(See Preliminary Amendment of 11/20/2003, page 9, Claim 11, line 4.  
Claim 11 issued as Claim 7.)

Column 37, line 35, Claim 18, "as set forth in claim 17" should read  
-- as set forth in claim 16 --  
(See Preliminary Amendment of 11/20/2003, page 11, Claim 16, line 1.  
Claim 16 issued as Claim 18 and Claim 14 issued as Claim 16.)

Column 37, line 51, Claim 18, "and is a magnitude" should read  
-- and || || is a magnitude --  
(See Preliminary Amendment of 11/20/2003, page 11, Claim 16, last line.  
Claim 16 issued as Claim 18. See also Column 37, Claim 19, line 67  
which contains the correct text.)

Column 37, line 51, Claim 19, "as set forth in Claim 16" should read  
-- as set forth in Claim 17 --  
(See Preliminary Amendment of 11/20/2003, page 17, Claim 30, line 1.  
Claim 30 issued as Claim 19 and Claim 15 issued as Claim 17.)

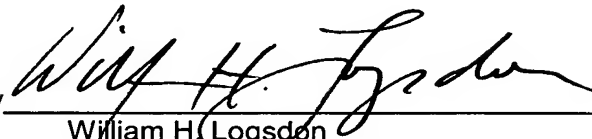
Patent No. 6,839,605  
Request for Cert. of Correction dated June 20, 2005  
Attorney Docket No. 2316-032210

Column 40, line 15, Claim 27, "target values value" should read -- target value --  
(See Preliminary Amendment of 11/20/2003, page 14, Claim 24, line 4.  
Claim 24 issued as Claim 27.)

Respectfully submitted,

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## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

PATENT NO. : 6,839,605  
DATED : January 4, 2005  
INVENTOR(S) : Park et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 33, line 64, Claim 18, "have a sane polarity" should read  
-- have a same polarity --

Column 37, line 35, Claim 18, "as set forth in claim 17" should read  
-- as set forth in claim 16 --

Column 37, line 51, Claim 18, "and is a magnitude" should read  
-- and || || is a magnitude --

Column 37, line 51, Claim 19, "as set forth in Claim 16" should read  
-- as set forth in Claim 17 --

Column 40, line 15, Claim 27, "target values value" should read -- target value --

{W0195809.1}

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PATENT NO. 6,839,605

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This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

JUL - 1 2005

Application No. Not Yet Assigned  
Paper Dated: November 20, 2003  
In Reply to USPTO Correspondence of N/A  
Attorney Docket No. 2316-032210



Customer No. 28289

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No. : Not Yet Assigned  
Applicant : Cheol-Jae PARK et al.  
Filed : Concurrently Herewith  
Title : **APPARATUS AND METHOD FOR  
DIAGNOSING FAULTS IN HOT STRIP  
FINISHING ROLLING**

**MAIL STOP PATENT APPLICATION**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**PRELIMINARY AMENDMENT**

Sir:

Prior to initial examination, please amend the above-identified patent application  
as follows:

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** begin on page 4 of this paper.

**Remarks** begin on page 18 of this paper.

an AGC gain shortage display unit for determining that an AGC gain shortage has occurred if the convergence period is longer than the corresponding preset value and displaying the AGC gain shortage.

Claim ~~11~~<sup>7</sup> (currently amended): The apparatus as set forth in any of claims 6, 7 and 9 claim 6, wherein the control fault determination unit further comprises:

5 a thickness/width polarity determination unit for determining whether a width variation and a thickness variation have a same polarity at a point when a Down Coiler (DC) is turned on, and determining that necking has occurred if the two variations have the same polarity;

a temperature/thickness polarity determination unit for determining whether there is a correlation between a temperature variation and a thickness variation, and determining that a material and temperature fault has occurred if there is the correlation;

10 a thickness/gap occurrence point determination unit for determining whether an operator roll gap intervention fault has occurred by determining whether the roll gap intervention of the operator has occurred in a stand where the thickness variation occurred; and

a necking display unit for determining that necking has occurred without a width variation if the roll gap intervention has not occurred at the point when the thickness variation occurred.

Claim ~~12~~<sup>14</sup> (original): The apparatus as set forth in claim 2, wherein the facility fault determination unit comprises:

a roll eccentricity fault diagnosis module for calculating upper and lower rotation frequencies of a backup roll if a thickness deviation between the corresponding target value set in the SCC setting unit and the actually measured value is larger than the consumer control tolerance, FFT converting an actually measured exit side thickness value and calculating a frequency fa corresponding to each spectrum intensity using the FFT converted value, determining whether there is a point where a value n times the rotation frequency of the backup roll and the frequency fa corresponding to each spectrum intensity coincide with each other, determining whether the spectrum intensity corresponding to the frequency fa is larger than a coefficient set in the SCC setting unit, and displaying a stand where roll eccentricity has occurred; and

a thickness gauge fault diagnosis module for determining whether a thickness variation larger than a corresponding preset value has occurred in a period of single sampling if the thickness deviation is larger than the control tolerance and the exit side thickness deviation is continuously larger than  $\beta$  over a preset value  $\gamma$  set in the SCC setting unit, and displaying a thickness gauge fault if the thickness variation larger than the preset value has occurred.

<sup>(18)</sup>  
 Claim ~~16~~ (currently amended): The apparatus as set forth in claim ~~14 or 15~~,<sup>(16)</sup> wherein the correlation calculation unit or spraying correlation calculation unit calculates the ~~correlation~~ correlations (C1, C2, C3, D1, D2, D3) the following Equation 1 if it is assumed that two data for calculation of the correlation are f and g, respectively.

$$C1 = \frac{\langle f, g \rangle}{\|f\| \cdot \|g\|}$$

$$= \frac{\sum_{k=1}^N f_k g_k}{\sqrt{\sum_{k=1}^N f_k^2} \cdot \sqrt{\sum_{k=1}^N g_k^2}} \quad (1)$$

where ~~Cx~~ Cx (x=1,2,3), Dx(x=1,2,3) is the correlation, f and g are data vectors,  $\langle f, g \rangle$  is the inner product of two vectors, and  $\| \quad \|$  is a magnitude of a vector.

<sup>(20)</sup>  
 Claim ~~17~~ (original): The apparatus as set forth in claim 1, the confidence rate determination unit comprises:

a thickness deviation excess determination unit for determining whether a thickness deviation between the corresponding target value set in the SCC setting unit and the actually measured thickness is larger than a consumer control tolerance;

a stand mean spectrum intensity calculation unit for calculating a mean spectrum intensity of each stand using spectrum intensities of upper and lower backup rolls if the thickness deviation is larger than the consumer control tolerance;

a spectrum intensity mean calculation unit for calculating a mean of spectrum intensities at frequencies other than the main frequencies of the upper and lower backup rolls;

a spectrum intensity comparison unit for calculating a deviation between the spectrum intensity at the main frequencies and the spectrum intensity at the frequencies other than the main frequencies; and

a confidence rate calculation unit for calculating the confidence rate of roll eccentricity using a deviation between the spectrum intensity obtained in the stand mean spectrum intensity calculation unit and the spectrum intensity obtained in the spectrum intensity mean calculation unit, if the spectrum intensity obtained in the stand mean spectrum intensity calculation unit is higher than the spectrum intensity obtained in the spectrum intensity mean calculation unit.

<sup>(21)</sup>  
 Claim ~~18~~ (original): The apparatus as set forth in claim 1, wherein the confidence rate determination unit comprises:

Claim <sup>19</sup>~~30~~ (new): The apparatus as set forth in claim <sup>17</sup>~~15~~, wherein the correlation calculation unit or spraying correlation calculation unit calculates the correlations (C1, C2, C3, D1, D2, D3) the following Equation 1 if it is assumed that two data for calculation of the correlation are f and g, respectively.

$$\begin{aligned}
 C1 &= \frac{\langle f, g \rangle}{\|f\| \cdot \|g\|} \\
 &= \frac{\sum_{k=1}^N f_k g_k}{\sqrt{\sum_{k=1}^N f_k^2} \cdot \sqrt{\sum_{k=1}^N g_k^2}}
 \end{aligned}
 \tag{1}$$

where C<sub>x</sub> (x=1,2,3), D<sub>x</sub>(x=1,2,3) is the correlation, f and g are data vectors, <f, g> is the inner product of two vectors, and || || is a magnitude of a vector.

the a third step of identifying a front end part, a tail end part and a body part using the actually measured data;

the a fourth step of calculating on-gauge ratios in the front end part, the tail end part and the body part using the preset values of the first step and the actually measured data of the second step;

the a fifth step of determining whether faults have occurred in the front end part, the tail end part and the body part using the preset value of the first step and the on-gauge ratios of the fourth step;

the a sixth step of determining whether an operator intervention fault, a material fault and a control fault have occurred at a point where a sheet thickness fault occurred; and

the a seventh step of calculating a confidence rate of the control fault using the preset values of the first step and the actually measured data of the second step.

Claim <sup>(24)</sup>21 (currently amended): The method as set forth in claim <sup>23</sup>20, wherein the sixth step further comprises the ~~sub-steps~~ steps of:

determining whether operator intervention has occurred in a roll gap, a roll speed and spraying;

<sup>5</sup> determining whether a material fault has occurred using a deviation between the entrance and exit side temperatures and the actually measured thickness value;

determining whether a facility fault by determining whether roll eccentricity or a sensor fault has occurred; and

<sup>10</sup> determining whether a control fault has occurred by ~~determining whether~~ examining FSU, AGC and a motor.

Claim <sup>(25)</sup>22 (currently amended): The method as set forth in claim <sup>24</sup>21, wherein the ~~sub-step~~ step of determining whether the operator intervention has occurred further comprises:

the a first step of presetting a preset target values, ~~such as a target thickness, a target load, a target roll speed and a target roll gap according to rolling conditions~~ value;

the a second step of determining whether an amount of roll gap intervention is larger than the corresponding preset value set in the SCC setting unit if a sheet thickness deviation is larger than a consumer control tolerance, and determining whether an operator roll gap intervention fault has occurred by calculating an amount of thickness variation and comparing the amount of roll gap intervention with the amount of thickness variation if the amount of roll gap intervention is larger than the corresponding preset value;

the a third step of determining whether a roll speed intervention fault has occurred by calculating an inter-stand tension and comparing the calculated inter-stand tension with the preset tension value set in the SCC setting unit; and

the a fourth step of calculating a sheet thickness using a stand load, comparing the calculated sheet thickness with the actually measured thickness, and determining that a spraying intervention fault has occurred if a deviation between the calculated sheet thickness with the actually measured thickness is smaller than the preset critical value and a pattern of the thickness variation coincides with a pattern of an exit side temperature variation.

Claim <sup>26</sup>~~23~~ (currently amended): The method as set forth in claim <sup>25</sup>~~22~~, wherein the sub-step step of determining whether the operator intervention has occurred further comprises the step of:

collecting actually measured data by measuring actually measured data, such as a thickness, an entrance side temperature, an exit side temperature, a rolling load and a roll gap of the rolled sheet.

Claim <sup>27</sup>~~24~~ (currently amended): The method as set forth in claim <sup>24</sup>~~21~~, wherein the sub-step step of determining whether the material fault has occurred further comprises the steps of:

the a first step of presetting a preset target ~~values~~ value, such as a target thickness, a target load, a target roll speed and a target roll gap according to rolling conditions;

the a second step of obtaining a sample rolling length using a maximal speed of each stand if a thickness deviation between the corresponding target value set in the SCC setting unit and the actually measured thickness value is larger than a consumer control tolerance, converting a thickness into constant length pitches based on the sample rolling length, and calculating a frequency of a period of a skid mark using the thickness data; and

the a third step of determining whether a skid mark has occurred by calculating a frequency corresponding to each spectrum intensity using the converted value obtained from the actually measured thickness FFT conversion unit, searching for a frequency coinciding with a frequency of the skid mark and evaluating a spectrum intensity of the coinciding frequency.

Claim <sup>28</sup>~~25~~ (currently amended): The method as set forth in claim <sup>27</sup>~~24~~, wherein the sub-step step of determining whether the material fault has occurred further comprises:

the a fourth step of determining whether there is an interval where a sheet thickness is suddenly changed;